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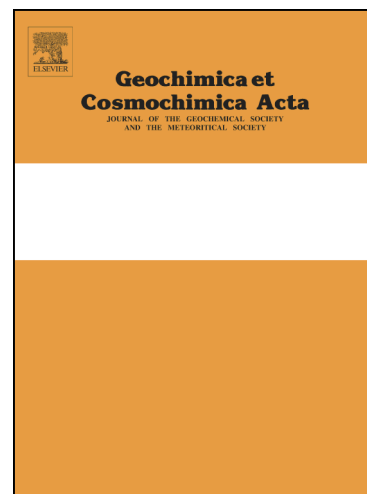
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1 Experimental calibration of a new oxybarometer for silicic 2 magmas based on vanadium partitioning between magnetite and 3 silicate melt

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7 Abstract

8 Partition coefficients of vanadium between magnetite and rhyolitic silicate melt, $D_V^{\text{mgt/melt}}$,
9 were experimentally determined as a function of oxygen fugacity (0.7-4.0 log units above the
10 fayalite-magnetite-quartz buffer), temperature (800-1000 °C), melt aluminum saturation
11 index (ASI=0.74-1.14), magnetite composition (0.2-14 wt% TiO₂) and pressure (1-5 kbar; at
12 H₂O saturation). Experiments were performed by equilibrating small ($\leq 20 \mu\text{m}$), V-free
13 magnetite grains in V-doped silicate melts (~100 ppm V) and then analyzing both phases by
14 LA-ICP-MS. Attainment of equilibrium was demonstrated by several reversal experiments.
15 The results suggest that $D_V^{\text{mgt/melt}}$ depends strongly on $f\text{O}_2$, increasing by 1.5-1.7 log units
16 from the MnO-Mn₃O₄ buffer to the Ni-NiO buffer, and to lesser (but still considerable)
17 extents on melt alumina saturation index (ASI; increasing by 0.3-0.7 log units over 0.4 ASI
18 units) and temperature (increasing by 0.3-0.7 log units over a 200 °C interval at a fixed $f\text{O}_2$
19 buffer). Magnetite composition and melt water content seem to have negligible effects. The
20 data were fitted by the following linear regression equation:

$$\log D_V^{\text{mgt/melt}} = 0.3726 * \frac{10,000}{T} + 2.0465 * \text{ASI} - 0.4773 * \Delta\text{FMQ} - 2.1214$$

21 , in which temperature is given in K, ASI refers to molar Al₂O₃/(CaO+Na₂O+K₂O) and
22 ΔFMQ refers to the deviation of $f\text{O}_2$ (in log units) from the fayalite-magnetite-quartz buffer.
23 This equation reproduces all of our data within 0.3 log units, and 89% of them within 0.15
24 log units. The main advantages of this new oxybarometer over classical magnetite-ilmenite
25 oxybarometry are (1) that it can be applied to rocks that do not contain ilmenite, and (2) that
26 it is easier to apply to slowly-cooled rocks such as granites.

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